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EDITORIAL.

OUR HOSPITAL EMOLUMENTS.

IT has been stated that rogues do not enter our ranks because there is insufficient remuneration in the work to attract them. Be that as it may, is it not about time for a thought to be given to that rather neglected side of our speciality—namely, its economics. Papers are written continuously covering every other phase, and yet how rarely does anyone ever venture into the domain of the emoluments of workers in this admittedly important department of surgery.

The time has already passed when the *dilettante* can satisfy the requirements of the operator. Real skilful administration of an anæsthetic is a *sine qua non* of the job. He who is incapable of supplying this grade of assistance in the surgical team is of little use to it. We do not quibble with this state of affairs for it is as it should be since the operator can only do his work properly when the anæsthesia is being properly administered.

But with this admission the question of just reward enters into the scheme, for it must be clear that in order for a practitioner to reach that high grade of efficiency required of him he must devote a great deal of time in keeping himself perfected, which means he must withdraw just that much of his earning time from other possible sources of income.

The reward generally offered by hospitals is well named an honorarium. No one regards it as remuneration.

Private work is, of course, on a higher status, although here again much may be said for an upward tendency. Hospitals tell us that we are expected to recoup ourselves in

this direction to recompense ourselves, and there is, no doubt, something to be said for this contention. But in practice this line of action cannot always be followed because the private fee-bringing case occurs frequently simultaneously with duty at the hospital.

May it not be respectfully suggested that this would be a legitimate direction for investigation by the British Medical Association? A survey of this matter would be timely, as it can hardly be doubted that something which so closely concerns the welfare of a considerable portion of the profession is worthy of active interest. It may or may not be good business on the part of lay boards to pay anæsthetists inadequate fees but on the question of general policy it is surely not in the interest of the public or the dignity of the medical profession that the services of qualified men and women should be assessed at so low a value. That men and women can be found to undertake service which is so poorly rewarded is not sufficient warrant for a perpetuation of that grade of compensation. Such an argument would meet with scant acceptance in any other field of endeavour. It is pleasing to note that here and there this injustice is recognized by lay boards, and reasonable fees have been established. But by far the greater number of hospitals continue along the old lines, perhaps, let us hope, because this unreasonable state of affairs has not been brought hitherto to their attention.

It is realized that there are hospital authorities who are compelled to practise the greatest economies, and in these instances no body of men or women are more willing to accommodate themselves to this condition than are anæsthetists. But it is hardly to be expected of them to be content to accept continuously a sacrifice which others are never called upon to accept, especially from those hospitals more or less plentifully supplied with funds.

There are numerous other arguments which can be brought forth for the anæsthetists' case but the few mentioned should suffice to call attention to a state of affairs which must sooner or later be gone into. The properly constituted authorities of the medical profession can find here a matter of economics worthy of consideration.

SIR JAMES Y. SIMPSON.

A revulsion to the sickening sights in the early hospital theatre caused the student Simpson to abandon his medical studies for a time. What effect, we may very well ask, had this sensitiveness to human suffering upon the seeker for something to assuage the pains of operative procedures?

As early as 1836, when still a house-surgeon, he asked: "Cannot something be done to render the patient unconscious while under acute pain, without interfering with the free and healthy play of the natural functions."

On the 15th of November, 1847, in that same room which was almost responsible for the change of his career, he gave the first successful public test of chloroform. Ether had been already accepted as an anæsthetic, but believing it to possess certain disadvantages, attempts were made to find some drug which was without these.

A Mr. Waldie of Linlithgowshire first suggested "perchloride of formyle" to the investigator. In the summer and autumn of 1847, he and his two assistants, Dr. George Keith and Dr. Matthews Duncan, tried various substances unsuccessfully, and, having been supplied by Messrs. Duncan and Flockhart with a quantity of the above mentioned drug, it was found to produce complete unconsciousness. Professor Miller, a neighbour, supplies us with an interesting account of this historic event: "These experiments were performed after the long day's toil was over, at late night or early morn, and when the greater part of mankind were soundly anæsthetized in the arms of common sleep. After a weary day's labour the three sat down and inhaled various drugs out of tumblers, as was their custom, and chloroform was searched for and found beneath a heap of waste paper, and with each tumbler newly charged, the inhalers resumed their occupation." The statement continues: "A moment more, then all was quiet, and then a crash. On awakening,

Dr. Simpson's first perception was mental. 'This is far stronger and better than ether,' he said to himself. His second was to note that he was prostrate on the floor, and that among the friends about him there was both confusion and alarm. Of his assistants, Dr. Duncan he saw moving heavily, and Dr. Keith kicking violently at the table above him. They made several more trials of it that eventful evening, and were so satisfied with the results that the festivities of the evening did not terminate till a late hour, 3 A.M."

Having thus, by personal trials, assured themselves of the power that chloroform possessed of producing unconsciousness it was next necessary to put it to a more practical test. It had been arranged for a certain operation, but fortunately a pressure of work kept Simpson from the appointment. This patient died on the first incision of the knife. Had the trial been carried out on this case, as had been intended, the history of anæsthesia might have been different. A blunder at this early stage would have made it very difficult to continue the tests, for, with the patient lying dead upon the operating table, the inference would no doubt have been drawn that the mishap was due to the drug used. In describing this event Simpson's daughter well suggests that the "divinity which shapes our ends" worked in her father's favour that morning.

A few days later saw the first successful test, when it was found that chloroform not only caused unconsciousness but anæsthesia as well. Present at the time was the French chemist, M. Dumas, who in 1835, had first accurately ascertained its composition, although the drug had been discovered by Soubsiran in 1831 and Liebig in 1832, the two savants working almost simultaneously.

It is difficult in these days of the accepted fact of anæsthesia to understand the wave of hostility with which Simpson had to contend in his campaign to popularise the use of chloroform. Instead of the widespread acceptance of so glorious a discovery for the relief of almost indescribable pain and suffering he met with a veritable avalanche of opposition. Within the profession and without there were many who condemned its use as being unwise, and when the arguments of pseudo-science failed to move this great

benefactor a battery of pseudo-religous arguments were hurled against him. What right had man to interfere with the ordained course of human nature? Had the devil put in our hands a weapon to undermine religion? It was even glibly asserted by many of the clergy that chloroform would remove the "primal curse on women," and to persist in its use was fighting against divine law. It was argued that it was against nature to take away the pangs of labour, and a medical contemporary thought it no great discovery anyhow, because it did nothing bue *save pain*!

Simpson met all these and more objections with reasoned replies. In our generation, when an anæsthetic of some sort is a commonplace, it requires a re-orientation of perception to reconstitute the mental state of that period in this particular. It appears, however, that the great body of mankind cared little for the niceties of controversy, and were quite content to accept the findings of this genius.

Simpson, although remembered now principally for his discovery of the anæsthetic effects of chloroform, played an exceptional part in the history of medicine in his time. As physican, surgeon, gynæcologst and accoucheur he stood at the very head of the profession. His reputation had spread throughout the British Empire, Europe and America, and it is said even to have been compared in world fame with Hermann Boerhaave, the great Dutch physician of the Seventeenth century. His patients made Edinburgh their Mecca, and entire hotels depended upon these for their support.

At eighteen he qualified, and at twenty-eight he was elected to the Edinburgh Chair of Midwifery. In his thirty-sixth year he was appointed Physician Accoucheur to the Queen in Scotland. By this time he was famous the world over. Born in 1811, he died in 1870, at the early age of fifty-nine.

METHYLPROPYLCARBINOL URETHANE.

The Physiological Action in Animals.

BY

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Foreword.

About ten years ago, impressed by the danger of chloroform anæsthesia, the inconvenience and post-anæsthetic troubles of ether, and more recently by the serious results following the use of cocain, I turned my attention to Hedonal (Methylpropylcarbinol Urethane); and after some limited personal experience, I proceeded to investigate the action more fully in animals.

The present paper is a summary of a work extending to 230 pages and including about 100 photographs of original tracings. Apart from the anæsthetic sphere, I believe that Hedonal has not been used in the medical field as it might have been, e.g. in diseases of the nervous system or those of high arterial tension. Records of the experiments are preserved and may be inspected by anyone interested in the subject.

Advent of Hedonal and Work done by Others.

Schmiedeberg (Strassburg) was the first to experiment with Urethane. He found, that as an anæsthetic, the amino group in its composition was too strongly opposed to the narcotic group. The stimulating radicle was therefore displaced by higher alcohol radicles, thus forming among others, Propyl and Isobutyl. These were far too insoluble.

Dreser, of Munich, (who was really the pioneer) in company with Bonhoeffer, made use of Schmiedeberg's suggestion. The ethyl radicle was displaced by the radicle methylpropylcarbinol, and thus in 1899 Hedonal was found. The bulk of further experimental work at this time was done in the laboratory of Professor Krawkow in Petrograd, by himself, Sidorenko, Fedoroff, Jeremitsch and others.

Krawkow introduced the Hedonal-Chloroform Narcosis, reducing the quantity of Chloroform necessary to about one-sixth. There seems to have been no experimental work whatever on the subject in Britain apart from the present; much early clinical work, however, was done in St. Thomas' Hospital, London, by C. M. Page.

Advantages of Hedonal.

1. There is little or no excitement during the induction of narcosis by intravenous injection.

2. Great muscular relaxation whereby it is possible to manipulate the under surface of the liver without shock. When this is possible with chloroform, I have always felt that danger was not far off; with ether such relaxation can hardly be obtained.

3. Hedonal is a diuretic and does not produce albumen, hæmoglobin nor casts in the urine.

4. Fatty degeneration does not occur in liver, kidneys nor heart after its administration.

5. No irritation of respiratory tract, because not excreted by lungs.

6. Specially advantageous in cases of low tension or hæmorrhage.

7. As a precursor by the mouth to chloroform, the quantity of the latter required is greatly reduced.

Disadvantages.

1. The apparatus for intravenous anæsthesia is cumbersome.

2. Unsuitable for conditions of high tension.

3. Unsuitable for plethoric patients.

4. Very long operations are sometimes followed by œdema in pendulous parts.

PROPERTIES.

13 Hedonal, which has the formula $C_6H_{13}O_2N$, is a white powder occurring in needles. It is not very soluble, one part dissolving in 120 parts of water at 98.6°F. Naturally it is still less soluble in normal saline, from which it readily crystallises out on cooling. The dose by the mouth is stated as 1—2 grammes.

ANÆSTHETIC EFFECT.

This has been tested in the mammal. A rabbit requires for the maintenance of anæsthesia by venous perfusion 2.2 grains of Hedonal per kilogram per hour.

Effects on the Eye :— These are similar to those of chloroform in the clinic; but they come on sooner, as the drug is perfused and not inhaled. A small dose of .17 grain caused quickly dilatation of the pupil by stimulation of the sympathetic, the light reflex being retained; a large dose, such as .57 grain caused dilatation to 11 m.m. due to paralysis of the third cranial nerve, with abolition of the light reflex.

12 The effect on the corneal reflex is not constant, nor of value.

Character of the Anæsthesia. This is not of the same nature as that of chloroform or ether: it is more like pure
18 hypnosis. Deep sleep may be present with the corneal reflex active. There is a long post-anæsthetic sleep.

Cause of Death. Respiration stops before the action of the heart.

EFFECT ON MAMMALIAN HEART.

The effect in the rabbit has always been marked diminution of the amplitude of contraction of the auricle and more so of the ventricle.

A dose of .16 grain Hedonal per kilogramme showed complete recovery to former condition soon after perfusion; a dose of .2 grain per kilogramme was not always followed by complete restoration of auricle and ventricle.

No appreciable change was observed in the cardiac rate.

Figure I shows the effect of 6 c.c Hedonal (1 per cent.) by perfusion into the jugular vein. The upper tracing—that from the auricle—shows 50 per cent. reduction in the ampli-

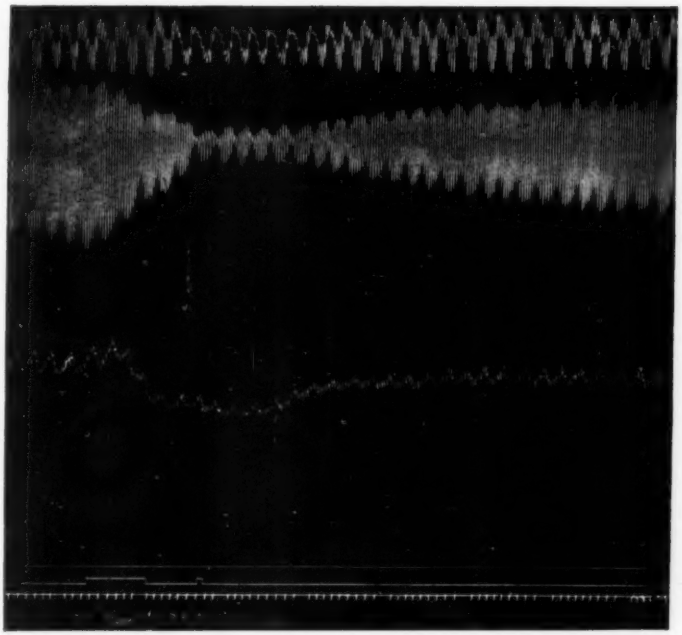

FIG. I.
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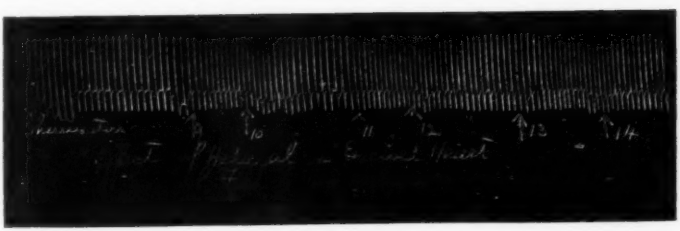

FIG. II.
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FIG. VII.
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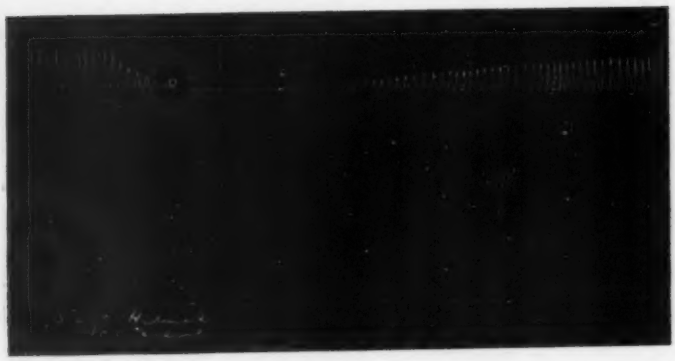

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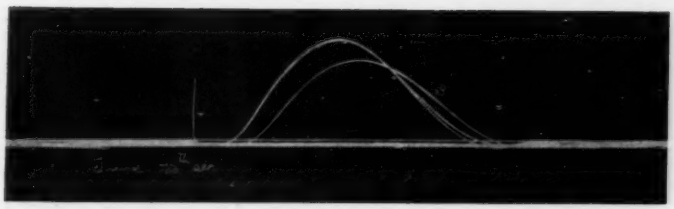

FIG. IX.
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FIG. X.
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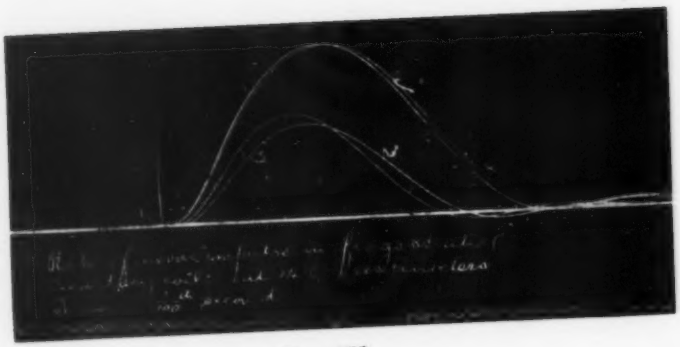

FIG. XI.
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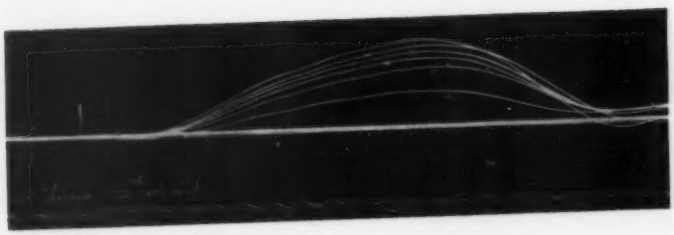

FIG. XII.
.24 nat. size.

tude of contraction, and the middle tracing—from the ventricle —shows 75 per cent. reduction.

EFFECT ON THE EXCISED HEART OF FROG BY PERFUSION.

The amplitude of cardiac contraction was diminished. The weakest solution to show this effect is 1 in 2000. A solution of 1 in 250 frequently stops cardiac action altogether.

The cardiac rate is increased at first by weak solutions, e.g. 1 in 2000, by as much as 18 per cent.; the rate is subsequently diminished. Solutions of 1 in 1000 show the retardation sooner, and solutions of 1 in 250 may show no initial increase at all, but stop the action of the heart completely.

The frog's heart stops in diastole.

When the cardiac action ceases, it can be restored by "Sherrington" solution.

A drop of Hedonal (.37 per cent.) applied externally to the heart's surface stopped all action, which action was restored by applying Saline Solution.

Figure II shows the effect of several doses of Hedonal and "Sherrington."

9. Hedonal 1 in 2000, 10 "Sherrington," 11 Hedonal 1 in 2000, 12 "Sherrington," 13 Hedonal 1 in 2000, 14 "Sherrington."

Figure III shows the effect of a strong solution of Hedonal on the frog's heart. 1 = Hedonal (1 in 250); 2 = "Sherrington."

EFFECT OF BLOOD PRESSURE.

This has been investigated in the rabbit and dog. In both cases when Hedonal was perfused by the jugular vein, the pressure was reduced. In the rabbit especially, but also in the dog, there was often seen an initial increase of blood pressure just as one may find an initial stimulating effect with some other anæsthetics.

In Figure I the bottom line represents the blood pressure from the carotid of a rabbit, there having been given 6 c.c. of 1 per cent. Hedonal. The resulting fall in pressure is a marked one and shows the initial increase.

Figure IV shows the same marked effect, the deeply indented line being that of the blood pressure from a rabbit

which had received three separate doses of 6 c.c. (.75 per cent. Hedonal). In this experiment the loss of pressure from these doses was respectively 18, 34 and 41 m.m. per kilogramme.

The effect of blood pressure in the dog may be seen in Figure V, where the lower broad line represents the pressure. A dose of 12 c.c. (.75 per cent. Hedonal) caused a loss in pressure of 3.3 mm. per kilogramme.

Effect on Arterioles of Mammals.

To ascertain the effect on the arterioles of the rabbit and dog, the kidney or a loop of intestine with mesentery was placed in an oncometer of suitable size. All the experiments showed vaso-dilatation. The effects were more prominent in the dog than in the rabbit. When the air-tube from the oncometer was connected to glass tubing containing a bead of water, (as described by D. Noël Paton), and Hedonal perfused by the jugular vein, the bead moved in one case 12 centimeters showing vaso-dilatation.

The effect in the rabbit may be seen in Figure IV where the oncometer tracing is the line passing through the deeply indented blood pressure line. In this case the intestine was chosen, and three doses of 6 c.c. were administered.

The effect on the dog may be seen in Figure V where the oncometer line is the narrow upper tracing. The bowel with mesentery was also used in this experiment, the dose being 12 c.c. (.75 per cent.).

Effect on the Arterioles of Frog.

The effect differs from that found in the mammal—there is vaso-constriction. The effect is independent of the brain and spinal cord. It is therefore not a reflex action. It seems to depend on the intrinsic nervous ganglia in the walls of the arterioles. On the other hand, the action may be upon the circular fibres of the muscular coat itself.

The method adopted consisted in perfusing the drug through the left aorta of the intact heart, the fluid escaping by the ductus venosus which was snipped by scissors. The drops fell on the lever connected with a revolving drum. Each

dose diminished the outflow by vaso-constriction. Calculations were made from the number of drops, and many experiments were made.

Effect on the Vagus Nerve-Endings in the Heart.

This has been examined in the rabbit and the dog. The physiological action of the vagus nerve-endings is not affected by Hedonal.

Figure VI shows the tracings from the auricle and ventricle of a rabbit. Faradic stimulations of the trunk of the vagus nerve, differing in intensity, are shown, the secondary coil standing at distances varying from 5 to 30 centimeters. Stand-still of the heart is seen in both of the tracings.

Effect on Respiration.

This has been tested in the rabbit. Hedonal causes reduction in the amplitude and reduction in the respiration rate.

In *Figure VII* the upper broad line is the respiration tracing from a rabbit, the lower one being the blood pressure line. A dose of 1 c.c. of .75 per cent. Hedonal was perfused by the jugular vein every 20—30 seconds for 17 minutes, the animal receiving 2.8 grains Hedonal per kilogramme. The amplitude of expansion lost 28 per cent., and the respiration rate 58 per cent. in the time mentioned.

Figure VIII is also from a rabbit. It shows a more profound effect on respiration than is usually found because the animal was moribund. A dose of 3 c.c. Hedonal caused a loss in amplitude of expansion equal to 87 per cent.; the rate was reduced by only 5 per cent. There was complete recovery from this dose.

Excitability of Nerve.

The frog's sciatic was tested and the excitability was found to be diminished.

Figure IX shows the results:—

Curves 1 and 2. Normal. One minute interval.

Curve 3. Taken after the nerve was one minute in Hedonal .37 per cent.

Curve 4. After one minute more in Hedonal. No response. No restoration by "Ringer."

The current used was the same all through.

Effect on Latent Period.

In one experiment, where the latent period was .02 of a second and the nerve had been placed for one minute in Hedonal .37 per cent., the latent period became .035 second—an increase of 75 per cent.

Effect on Conductivity of Nerve.

Hedonal diminished nerve conductivity in the Frog's Sciatic. *Figure X* shows the results.

Couplets 1, 2, 3. Normal. Taken every half minute. Couplets 4, 5, 6, 7. Taken every half minute, the centre of nerve being placed in Hedonal .37 per cent. and proximal extremity stimulated. Couplet 8. Stimulation at distal extremity.

M = Make.

B = Break.

Rate of Nerve Impulse in Frog.

The rate is diminished. *Figure XI* shows the result. The length of the sciatic nerve was 40 mm.; and the muscle 30 mm.

Curve 1. Normal. Proximal end stimulated. Curve 2. Normal. Distal end stimulated. Curve 3. Nerve one minute in Hedonal .37 per cent. Proximal end stimulated. Curve 4. Hedonal curve. Distal end stimulated. In this experiment the normal rate was 6400 mm. per second, and the rate after treatment was 4571 mm. per second—a loss of 28 per cent.

Effect on Muscular Contractility.

This was investigated in the Frog's Gastrocnemius.

Contractility was diminished by Hedonal. In the present experiment as shown in *Figure XII*, the work done by the muscle estimated in gramme-millimeters was reduced by 66 per cent. after treatment by Hedonal.

Figure XII. Muscle length 28 mm. Secondary coil at

44.5 centimeters. Curve I. Normal. Curves 2, 3, 4, and 5, taken at one minute intervals, the nerve being in Hedonal .37 per cent.

I wish to thank the British Medical Association for a grant towards this work.

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A SURGEON'S TRIBUTE TO ANÆSTHESIA.

As a surgeon, I come to you with a very definite sense of gratitude and offer my tribute of praise to your unselfish and faithful endeavour in the prevention of pain. You have brought the gift of anæsthesia from the gods of Olympus.

We, who wield the scalpel, for countless centuries have drawn the sharp burning line between health and disease and cast off the evil from the good. With boldness, courage and high purpose, we severed the quivering flesh that the sufferer might live. Our hearts bled with the patient. Pity consumed us like a fire—then you came. Not only did you abolish surgical agony and ease the pangs of childbirth, but you widened the scope of operative treatment. You advanced the science of medicine to an incalculable degree.. To you we owe our freedom of action in the operating room. You have opened the way to humane research. You have permitted us to follow disease into the deeper recesses of the body and there to pluck it out.

You are co-workers in surgical relief. It is no trivial part you play in service.. Yours is no mere accessory to scientific treatment. To you is entrusted the fragile mystery of life, and while we seek to free the body of its morbid blight, you must hold all safe and sound the greatest treasure of the universe.

Yours are the gentlest and kindest hands of Medicine. Dr. Saxton Pope, San Francisco, *Anæsthesia and Analgesia*.

THE SIDNEY RAWSON WILSON PRIZE

As announced in the July number of the *British Journal of Anæsthesia*, for the best INHALATION ANÆSTHESIA RESEARCH EFFORT, worthy of a premium, carried out by a citizen of the British Empire between the present date and December first, 1928, a prize of Fifty Pounds is offered.

Every competitor is expected to conform to the following regulations :—

(1) To forward to the Secretary of the *British Journal of Anæsthesia* on or before the first day of December, 1928, a typewritten report of his or her work, in triplicate, with a *nom de plume* thereon, and also accompanying same a sealed envelope having the same *nom de plume* inscribed on the outside and his or her name and address within.

(2) All competitors assign to the *British Journal of Anæsthesia* all rights of publication.

(3) The *British Journal of Anæsthesia* reserves the right to decide if any effort received is of a sufficiently high grade to warrant the award.

CURRENT COMMENTS.

WHAT MANCHESTER DOES TO-DAY ——

COTTONOPOLIS has set a good example to the remainder of Great Britain by organizing the first local anæsthetic society.

This is a move in the proper direction, and it is hoped that other large cities will now follow along the same lines. Local societies have certain advantages over general organizations, and there can be little doubt as to their necessity in these days of forward movement. Only by contact can workers in the same field know each other better; certainly to their mutual advantage, quite aside from the stimulus such meetings afford for greater interest in anæsthesia. Besides, it is the surest sign of virility.

It is the obvious duty of every anæsthetist to join one of the two larger general organizations—the Scottish Society, or the Anæsthetic Section of the Royal Society of Medicine. At the same time, for those of us who find the meetings of these not easily accessible, a society in their local area will serve to supply the necessary pabulum within easy reach, while the national associations possess our broader allegiance.

Never in the history of anæsthesia has there been a time when the art and practice of anæsthesia have received greater encouragement from the profession at large, while never have the demands for high grade administration been more emphatic. Day by day the requirements are becoming more exacting, the field broader, the technique more complicated. To meet the needs of present day surgery those who play our rôle must take advantage of every opportunity to keep abreast of the times. We have our Journals and we have our national associations. Our next line of advance must be our Local Societies.

THE HENRY HILL HICKMAN CENTENARY.

A fine compliment is being paid to the memory of this early worker in anæsthesia by the Associated Anæsthetists of the United States and Canada in associating the name of Hickman with their Seventh Annual Congress, to be held at Minneapolis, June 11—15, 1928. The programme will include papers on the work done by this pioneer, and the occasion should prove a noteworthy one.

Hickman occupies an important place in the history of anæsthesia, not perhaps so much for the practical results of his experiments, as for the example of his activities. He was only 29 when he died but in the few years he had to devote to his work he displayed an energy which calls for great admiration even in these high-pressure days. In his period the term "suspended animation" was the catch phrase of the day. He concluded that anæsthesia and it were analagous and he declared that this state could be brought about by the delimitation of atmospheric air or the administration of CO_2. What Hickman observed was no doubt what many anæsthetists since have noticed, viz, that the shutting off of air produces unconsciousness. This, however, is a different thing to anæsthesia, and one can only account for his belief in this method as an anæsthetic by its producing syncope and shock.

In any case, men of standing in England gave him no encouragement. The French Academy, although it listened to his pleas, proved equally obdurate. And so ended his career, for a few months later he died a discredited man.

Some few months ago it was reported that his grave was in a deplorably neglected condition. If this be true it is surely a reflection on the profession of medicine to allow such a state to continue, once having been made aware of the fact. Shall not the profit be honoured in his own land even in death?

THE ANÆSTHETIST'S INSURANCE.

Insurance policies are notoriously verbose in their provisions, and the proverbial Philadelphia lawyer will be needed frequently to disentangle the long and oft times vague literary

construction which seems to be their prevailing style. It is, therefore, a matter of a great deal of importance for each of us to give this part of the policy a good deal of attention.

These remarks are apropos of a recent case in which the widow of a deceased anæsthetist found the amount of her insurance cut down considerably. The contention of the Insurance Company was that an extra premium should have been paid for the hazard undertaken by the insured in order to have benefited fully.

It is quite likely that the Company's construction is correct, but it is obvious that in so far as the dead anæsthetist was concerned he evidently understood or felt that he was fully covered by his policy, and was accordingly making proper provision for his family.

It is worth while reminding ourselves occasionally that the calling of an anæsthetist carries with it risks that are more or less peculiar to the work we do, and with the ambiguity of many policies it behoves us to pay very particular attention to so vital a matter. At the same time it is something that we should not put off till tomorrow.

Aside from the question of life, sick and accident benefit, there is the necessity of being covered for damages, and the two concerns which are run by the profession itself are ideal for this purpose.

To emphasize the need of membership in one of the two protection societies would be "to elaborate the obvious." While, fortunately, the necessity of legal defence for an anæsthetist as an anæsthetist rarely occurs, yet, there is always the possibility that some one may some day find himself in that unhappy position, for as has already been stated, the anæsthetist's calling has its own hazards. Generally speaking, his medico-legal status is the same as that of the ordinary medical man, but in view of his specialist's character he assumes an extra responsibilty before the law.

IS DEATH PAINLESS?

Whether death is a painful or painless process, has proved a matter for speculation throughout the ages, and scientists

have answered the question in various ways. However, since no one has yet returned from the great beyond to report from personal experience, the subject can only be considered speculatively.

May not certain conclusions, acquired in the practice of anæsthesia, help in throwing some light in this direction. Would it be rash to suggest, as a matter of fact, that *death is painless.*

One does not speak of the illness or accident which precedes demise but only the actual point where life departs. Early physiologists and anæsthetists confused *unconsciousness* with anæsthesia. They failed to realize that the two are quite different and distinct conditions. Even to-day there are still those who do not differentiate them into the entities that they are.

One may produce unconsciousness of a type without abolishing loss of sensation just as sensation may be abolished and yet consciousness remain. But if this unconsciousness is continued long enough a light stage passes into a deeper stage, and death results. In anæsthesia we avoid this extension of asphyxia by letting the patient have oxygen.

Loss of consciousness may be artificially produced by depriving the individual of oxygen. When enough oxygen is removed unconsciousness takes place. We may conclude that a continuance of this deprivation produces a stage where with the loss of consciousness there is a corresponding loss of sensation.

Which brings us to our *quod erat demonstrandum,* viz: that at the time of actual death all sensation has been lost because a deprivation of oxygen has brought about unconsciousness.

In every death there has been a period immediately preceding that state when, for one reason or other, oxygen is no longer being absorbed. The individual then becomes unconscious, although still living. Light unconsciousness passes into deep unconsciousness. At this point he neither perceives or feels, and when the end comes it is without pain or other sensation.

EPHEDRINE.

From time to time new remedies are added to the anæsthetist's armamentorium, the latest being Ephedrine. This drug is an alkaloid obtained by Nagai in 1887 from the Chinese drug ma huang, but only recently standardized. It has certain chemical and therapeutic similarities with epinephrine (the active principle of the suprarenal capsule) but must not be confused with same. The drug is now placed on the market in the form of a hydrochloride and a sulphate but the former alone, anyway for the present, is of interest to anæsthetists

In the November number of *Archives of Surgery* there is reported by Blalock a series of experiments in the treatment of shock following hæmorrhage in which he found the drug satisfactory. The consumption of oxygen was increased and the general condition of the animals seemed improved. The minute cardiac output increased each time after the drug was given, the rise being well sustained. When the shock state was not extreme the animal seemed to be greatly benefited.

In comparing ephedrine with caffeine therapeutically, Blalock votes for the former.

As a tentative dose he recommends one to two grains of the hydrochloride subcutaneously, but this should be followed by intravenous saline infusion and transfusion, as routine.

HICCOUGH DURING ANÆSTHESIA.

This condition is occasionally met with in the early stages of anæsthesia and usually passes off with the deepening of narcosis. But there is the exceptional case when it is found that it persists for a longer period and then becomes annoying to both operator and anæsthetist. How much of this is due to ether has never been determined. In view, however, of the known efficacy of preparations of ether administered internally for ordinary hiccough one finds it difficult to square theory with the practice.

Generally speaking, irritability of the nerves supplying the diaphragm is principally responsible for the condition, and this may be brought about by a number of causes.

It is interesting to learn that S. J. Cantor (*Medical Journal of Australia*, June 11, 1927) reports an efficacious and at the same time a very simple treatment. He forcibly flexes the head on the chest for a couple of seconds. He declares that this procedure arrests the hiccough immediately and in dramatic fashion. Relapse is uncommon, and in any case the method may be repeated with assurance of success.

A NEW JOURNAL OF ANÆSTHESIA.

A happy sign of the times is the widespread interest in anæsthesia as instanced by the announcement of the establishment of yet another journal to be devoted altogether to anæsthesia, namely, the *Zeitschrift für Narkose.*, This periodical is to see the light of day at Wurzburg, Germany, in January, 1928, and is to be edited by the well known Professor C. J. Gauss, Director of the University-Woman's Clinic, Wurzburg, and Dr. Herman Weiland, of Heidelberg University.

The inauguration of a Journal of Anæsthesia in Germany is indeed a stepping-stone in the history of this subject, and it is pleasing to note that in a country where science has been placed upon such a lofty plane its savants are focussing attention in this direction.

Rich as has been its past story there is still much to be accomplished in this field, and, in order to mirror properly its various reflections, its own periodicals are essential. The printed word is the brain's stamp, and only in the typed page can the world see transplanted the minds of men of every nationality. So, when a new periodical is born, it means that all the world will be able to learn the latest thoughts and findings of those who work in that particular department of science.

The results of practice and research are therein placed before its readers as a panorama of progress whence discerning observers may profit at will..

It proves all things to all men. It enables the Practitioner to utilize the findings to perfect his skill and improve his technique. The Research worker becomes *au courant* with

his confreres and thus is able to check their conclusions and avoid wasting time and effort in needless repetition; while the Student obtains a stimulus of new ideas—ideas which perhaps escaped the author himself.

The British Journal of Anæsthesia takes this opportunity of extending its congratulations to *Die Deutschen Zeitschrift fürNarkose* and wishes it great success and long life. The association with it of such great scientists as its distinguished editors augurs well for its coming usefulness.

A WORD TO MANUFACTURERS.

As the practice of anæsthesia broadens it becomes increasingly necessary to simplify its ever multiplying paraphernalia. It is to be feared that manufacturers are not paying the attention to this item that is desirable. In many instances too much is left to the imagination of the anæsthetist, who, usually, requires to work in the dark, when, for the good of all concerned, he should be free to devote all his time and wits to the job at hand. Take as an example apparatus. The obvious thing to do would be to have the various parts so clearly marked that there could never arise any doubt as to where the necessary attachment aught to be made. What frequently happens, however, is that this extremely important feature is left to be worked out by the administrator. As an error in this particular may easily prove a serious matter the importance of making those machines as "fool-proof" as possible is of great consequence. While it is true that the average experienced anæsthetist may be relied upon to work these things out for himself correctly, it happens occasionally that beginners find mechanical defects confusing.

Another instance of what proves perplexing is the disregard at times for the necessity of giving a distinguishing character to each type of gas cylinder. Manufacturers might be well advised to colour each container differently, while, at the same time, marking the name of the contents clearly and boldly. It would be better if common standards were adopted by all so that in the course of time a certain colour would represent a specific gas.

It is not intended to be captiously critical but in the work of the anæsthetist it is highly necessary to leave little to fortune. All of his materials and tools should be as nearly perfect as it is possible to make them. To those concerned we respectfully commend these suggestions for their consideration.

EMERGENCY EQUIPMENT.

When an emergency arises in the course of an anæsthesia time is an all-important factor. Whatever there remains to be done must be done quickly, if the patient is to be saved. A knowledge of the various remedies and procedures are naturally essential to every anæsthetist, and no one can conscientiously undertake this work who has not previously perfected himself in this matter.

But something more is required than knowing what to do and how to do it. The necessary equipment must be always and immediately available, and it is up to the anæsthetist to see that it is so, for otherwise in the time of need he may find himself working with tied hands.

Generally speaking, in the hospital theatre, a good R.S.O., together with an efficient Sister, will see that everything required is constantly available. Nursing Homes vary in this essential. In any case it is well that the anæsthetist assure himself from time to time that the articles which he may at any given moment require quickly, are within easy reach. Too much reliance must not be placed upon others. The confusion frequently attendant upon this emergency is only increased by a failure to obtain quickly a properly charged hypodermic, a cylinder *containing* oxygen or CO_2 mixture, a long intra-cardiac needle, or the transfusion apparatus with the proper solutions for same. Precious moments are lost if it becomes necessary to run about collecting these things from here, there and everywhere, especially since we know, as has already been pointed out, that a few minutes are all that may be vouchsafed us.

Someday, hospital and nursing home efficiency will have become so advanced that periodical life-saving drills will be

an esential feature of every first-class theatre staff, just as fire-drill takes place regularly by a fire-brigade in preparation for a possible fire-call. Until that happy day arrives it might be well for every anæsthetist to see that there is *always available* all that he may require quickly in time of need. Our duty to our patient and to the art which we practise requires us *to leave nothing to chance*.

E. 107.

Willstaetter recently announced the production of a substance which is the result of the yeast reduction of bromal, and which he referred to as E. 107, or avertin. Experiments proved this drug to be a rectal anæsthetic. A new method of preparation of the necessary solution has resulted in the less frequent irritation of the bowel which was at first complained of.

Eicholtz and Butzengeiger (Rectal Anæsthesia with E. 107, Ges. für Chir., 51, Berlin, 1927) report their experiences in 300 cases in which avertin was used rectally. Veronal is given on the evening before, and pantopon one hour before, the operation. Twenty-five minutes after the anæsthetic solution has been injected the patient is usually asleep, the dosage being regulated in accordance with his weight. If the desired effect has not been produced the injections are repeated in six, and ten minutes, if necessary.

A deep sleep is the usual result, which continues from one to four hours, although the authors found it necessary to administer ether upon occasions, but chloroform is shunned. Of the series reported 200 were laparotomies. Since the drug is eliminated by the liver it is important that liver cases are avoided, as well as where an inflammatory condition of the colon exists.

The drug has recently been extensively tried in the German clinics but the conclusions drawn are by no means unanimous. Nordman (Berlin) tried it in 250 cases, the ages varying from 15 to 70 years, but he believes it is unsatisfactory to regulate the dose by the weight of the patient. He found it necessary

to administer small amounts of ethyl chloride or ether in 40 per cent. of his cases. He thinks it is a disadvantage for the patient to sleep so long after the operation because it calls for extended observation.

Sauerbach (Munich) met with a series of unfavourable experiences which decided him to give the method up for the present. Some of his patients were still very cyanotic four hours after operation, and others typhoidal. He had two deaths with intestinal symptoms two days after performing an amputation, and a third with the same manifestations after a gastric carcinoma.

Reischauer (Breslau) had two deaths in sixty anæsthesias, one of which was due to cardiac dyspnoea four hours after operation. Complete anæsthesia was not produced in a large number of his cases.

Nuger (Berlin) who did 345 anæsthesias by this method, emphasized the necessity of following closely the directions in preparing the solution, which must always be fresh. He had no deaths, but in eight of his cases severe cyanosis was observed. He urged further trials.

Melzner (Koenigsberg) in 100 anæsthesias had no colonic mucosa irritation, but found in half of his cases inhalation anæsthesia was necessary. He thought it to be a more dangerous anæsthetic than others.

The drug has not yet been released by the manufacturers, the I. G. Dye Works, for general use, the supplies for the above experiments having been furnished privately. It is perhaps too soon to express a definite opinion as to its value. The report of four fatalities is ominous, but even in this particular regard must be had for the newness of the drug, the difficulty in fixing a proper dosage, and the apparent uncertainty of obtaining a satisfactory solution. For the present it perhaps would be as well to suspend judgment.

PRELIMINARY MEDICATION IN GENERAL ANÆSTHESIA, WITH SPECIAL REFERENCE TO THE MARGIN OF SAFETY IN POST-OPERATIVE LUNG LESIONS.

By James T. Gwathmey, New York.

BRIEF abstract: Result of extensive experimental investigation in which approximately 500 animals were employed to determine the value of preliminary medication in general anæsthesia. This laboratory data shows, what clinical experience verifies, that proper preliminary medication is of equal importance with the general anæsthetic agent. It may mean the difference between life and death and all methods of anæsthesia should be preceded by preliminary medication.

Regardless of the anæsthetic used in the animal experiments—whether ether, nitrous oxide-oxygen or one of the hydrocarbon gases (acetylene, ethylene or propylene)—if preliminary medication was not administered pathologic lesions in the lungs were invariably found at necropsy.

The lungs were usually distended, congested, œdematous and contained petechiæ. After ether and oxygen it was not unusual to find atelectasis involving a portion of one lobe and often massive atelectasis involving one or more of the lobes. The lungs of the animals that received preliminary medication were normal.

When ether is the terminal anæsthetic preliminary medication increases the margin of safety as regards life more constantly and efficiently than any of the other general anæsthetics.

Proper preliminary medication protects the patient. The brain is better protected than if inhalation is used alone, and reflex inhibition of the heart is almost impossible. The excitement stage is eliminated and the pulse, respiration and blood pressure approximate the normal. After operation the patient usually awakens without nausea, vomiting, wound or gas pains, and rarely requires a sedative.

ABSTRACTS.

Anæsthetic toxicity. V. E. HENDERSON, *Canadian Med. Assn. Jl.*, Oct. 1297.

By substituting bromoform for chloroform Henderson found, in experiments upon animals, marked changes in the liver. He was also able to demonstrate an excretion in the urine of an inorganic bromide of the bromine contained in the bromoform given as well as inorganic bromides in the tissue. He concludes from this that a portion of the bromoform is broken up in the body and that the peculiar intoxication may be due to metabolic decomposition. Assuming that this type of intoxication occurs also with chloroform the fatty changes found in the liver and heart muscle may thus be accounted for.

Indications for intratracheal anæsthesia. C. C. STEWART. *Canadian Med. Assn. Jl.* Oct. 1927.

In *nose* and *throat* and *oral* surgery Stewart regards this method as ideal because it gives the operator the fullest use of the operative field and at the same time renders aspiration of foreign material practically impossible. He thinks, however, that a previously existing chronic tracheitis would contra-indicate its use. In operations on the *face, head* and *neck* it may be used largely on account of the mechanical advantages it confers, while in operations on the *spinal canal,* with the patient in the prone position, the anæsthetist is left free to assume general control of the patient, being less hampered than if he were in an ether saturated tent under the patient's face.

As regards *upper abdominal* surgery he gives it as his experience that shock during operation and post-operative morbidity are less with this method.

In a limited number of cases where the use of ether is contra-indicated and the proximity of the anæsthetic is not desirable,' intratracheal gas-oxygen may prove useful.

Anæsthesia in thyroid surgery. A. F. RENNEKER. *Am. Jl. of Surgery,* New York, New Series, II, 5.

In this very difficult type of surgery the author believes gas and oxygen to be the best anæsthetic, providing the "surgical team" work together in perfect understanding. He came to this conclusion after a series of four thousand cases notwithstanding, as he avers, this is by no means easy to administer. However, given a first-class assistant

in whom the surgeon has unbounded confidence and who is able to forestall his every move, and an anæsthetist who is qualified to advise the operator as to when to proceed from an incomplete to a complete operation. Renneker is satisfied that this is the safest anæsthetic provided also that proper preliminary medication is employed.

Local anæsthesia in labour. E. PRIBRAM. *Klinische Wochenshrift, Berlin,* July 2, 1927.

In one hundred cases of labour Pribram employed paracervical anæsthesia accompanied by injections of pituitary solution and followed by conduction anæsthesia of the pudendal nerve. There are few contra-indications for this method, the principal ones being contracted pelvis, inflammation of the vagina, and fever of undetermined character. He mentions as an undoubted advantage the fact that there are fewer perineal lacerations.

Perineal prostatectomy. The use of sacral anæsthesia. WINFIELD SCOTT PUGH. *Clinical Medicine and Surgery,* Chicago, Nov. 1927.

In order to discover in what proportion of cases the sacral hiatus was closed, Dr. Pugh studied over 2000 sacra and found the proportion of closed or almost closed as being less than two per cent. He thus asserts that the former belief that sacral anæsthesia would never become a popular procedure because of the difficulty of entering the hiatus will not bear investigation. In fact he states that Hugh H. Young, of Baltimore, does all his numerous cases by this method. The best results are obtained at the Urological Department, City Hospital, New York, with about 40 c.c. of a half per cent. novocaine solution.

Ethylene. J. A. JOHNSTONE. *American Medicine,* June, 1927.

In those cases where, for any reason, morphine has been administered pre-operatively and Ethylene is the anæsthetic, Johnstone adds one to five per cent. carbon dioxide as a respiratory stimulant in order to overcome the depressant effect of the morphine.

A report of 200 nitrous oxid-oxygen anæsthesias of children under 10 years of age. DOROTHY A. WOOD. *Current Researches in Anæsthesia and Analgesia,* Oct. 1927.

The author states that the procedure differs not in the slightest from that used in administering to adults. In strong vigorous youngsters the induction is with pure nitrous oxid lasting usually about forty-five seconds; then the mixture of nitrous oxid-oxygen is given and continued to the end, when pure oxygen is given for about a minute.

In very pale, anæmic, weak children the induction is made with a mixture of nitrous oxid and oxygen, the patient never being given pure nitrous oxid or allowed a too high percentage of nitrous oxid during anæsthesia. Here also pure oxygen is given at the close.

Rebreathing and a closed system is used when relaxation is insufficient. Contrary to the old theory that children could not manage an anæsthetic with a closed system, no difficulties have been found.

She draws the following conclusions :

1. Nitrous oxid is the anæsthetic of choice, especially in respiratory tract infections, tuberculosis, high fevers, diabetes, kidney pathology, and acute infections of the ear, nose and throat.

2. Children bear nitrous oxid-oxygen anæsthesia as well as adults, and there should be no age limit for its use.

3. Contrary to the old theory, children seem perfectly able to handle a closed system of anæsthesia.

4. Technique of administration to children is the same as to adults.

5. Colour changes in pale children are difficult to detect, and these children should receive a larger percentage of oxygen in the mixture.

6. No ill effects were noted from repeated anæsthetizations of the same subject.

7. Two hundred administrations of nitrous oxid-oxygen were given without ether, without complications and without a fatality.

Hiccough and CO_2

RUSSELL F. SHELDON (*Anæsthesia and Analgesia*, Feb. 1927) reports a series of four cases in which he alleges the hiccough was lessened or controlled by the administration of a mixture of CO_2 and oxygen. In three of these cases the hiccough followed the operation and continued for varying periods but were ultimately suppressed by this treatment. In the fourth case, which occurred during the operation, 25 per cent. carbon dioxide was used with the oxygen and the hiccough stopped after eight breaths.

Mechanism and treatment of experimental shock. ALFRED BLALOCK. *Archives of Surgery*, Chicago, Nov. 1927.

In this article Blalock reports the results of shock following hæmorrhage produced experimentally upon animals, and the treatment of same by various procedures. The injection of ether intramuscularly did not cause any significant change in the pulse rate or blood pressure and only slight increase in minute cardiac output. Intravenous injection of ether caused the immediate death of the animal. Intra-arterial injections resulted in the mean blood pressure being elevated and the minute cardiac output was strikingly elevated although after twenty minutes a depression set in.

He found that *ephedrine* each time increased the minute cardiac output and this rise was well sustained, lasting for as long as two hours. He recommends this drug to be used subcutaneously in amounts of one or two grains, the hæmorrhage once having been controlled.

Circulatory disturbances associated with subarachnoid nerve-block. GASTON LABAT, *Long Island Med. Jl.*, Brooklyn, N.Y., Oct. 1927.

In this article Dr. Labat demonstrates his contention that the Trendelenberg position is the ideal one immediately following subarachnoid block in spinal anæsthesia. He concludes that any patient who is placed otherwise suffers from an acute anæmia of the parts which are raised. If such patients are placed head up, they will suffer from anæmia of the brain, an acute anæmia, because the spinal injection of an anæsthetic solution results in an immediate action, immediate anæsthesia, immediate relaxation of the splanchnic blood-vessels and a drop or fall of the blood by gravity.

Contrary to what might be expected the solution does not gravitate towards the head. Clinical observations have shown that once the anæsthesia has stopped at a certain level, you can suspend the patient by the feet and it will remain at that level, and if you place the patient head down long enough, the anæsthesia wears off toward the feet.

The effect of anæsthetics on the body as a whole. W. WEBSTER. *Canadian Med. Assn. Jl.*, Nov. 1927.

This is perhaps the most important consideration in the choice of and in the administration of an anæsthetic. Looking over the statistics relating to deaths from the various anæsthetics in use, one receives an impression of safety—of how slight is the risk run in taking an anæsthetic. When, however, we consider the possibilities of injury to parts of the human structure which may follow as a result of anæsthesia we are confronted with an altogether different aspect of the situation. We find that a more or less temporary derangement of some part of the body may result, or in rare instances even permanent disability. The vital organs, heart, liver, kidneys, and nerve cells, are all potentially liable to serious injury, for unfortunately anæsthetics do not merely inhibit the action of the nervous system, but they alter, to a greater or less degree, the metabolism of every cell in the body. We may consider this from the standpoint of primary and secondary effects. The primary effects are the changes produced by the anæsthetics themselves on the cells of the body, such as the inhibition of oxidation in nitrous oxide anæsthesia, and the destruction of liver cells by chloroform. The secondary effects are the changes caused by substances which are produced in the body by the derangement of the normal metabolism, such as the decrease in the normal alkalinity of the blood, an interference in the function of the liver cells, hæmolysis, etc.

The perfect anæsthetic is not yet. Whether the precious gas or liquid, whichever it may be, will ever appear, is extremely doubtful. At present, among the known chemical substances, there seems to be nothing likely to displace those already in use. Although,

in the last few years, several new gases have been employed, they all, like those previously in use, fall short of perfection, inasmuch as they, along with their anæsthetic power, produce certain undesirable effects and lack, wholly or in part, certain desirable qualities. At present we are unable to produce complete oblivion to painful stimuli with the certainty of not having caused at least a slight, temporary damage to some other organ or tissue..

Spinal anæsthesia. Commander JOSEPH J. A. MCMULLIN, M.C., U.S. Navy. *Surgery, Gynæcology and Obstetrics*, Nov. 1927.

This article which deals with 392 cases, is especially interesting for those in the senior service, who are frequently compelled to work short-handedly, in which case the operator may be his own anæsthetist. There were no deaths in this series but two instances of alarming reactions and those of a milder nature were numerous. The average drop in the blood pressure was 18 points systolic and 15 points diastolic while the pulse rate markedly decreased with fair frequency. In 10 cases adequate and satisfactory anæsthesia was not obtained. In prolonged operations it was found necessary to add local or general anæsthetics. For the upper abdomen injections were made between the eleventh and twelfth thoracic vertebræ, and for the lower abdomen between the second and third, or third and fourth lumbar vertebræ.

Intratracheal inhalation. P. J. FLAGG. *Preliminary report of a* simplified method developed under the supervision of Dr. CHEVALIER JACKSON. *Archives of Otolaryngology*, V. 394, 1927.

The method consists in substituting inhalation for insufflation and is said to possess the following advantages: the elimination of complicated motor-driven apparatus, manometers and devices for warming and heating vapour; an operating field free from escaped insufflated vapour and anæsthetic; normal respiratory rhythm and amplitude; conservation of carbon dioxide; exclusion of foreign matter such as blood and vomitus, and ability to maintain the lightest anæsthesia.

The method requires intubation by direct vision and the presence of the intratracheal tube in the mouth.

The therapeutic uses of Carbon Dioxide. JAMES C. WHITE and LEWIS M. HURXTHALL. *Boston Med. and Surg. Jl.*, Dec. 15, 1927.

Following the general adoption of ethylene in anæsthesia, there has been a great improvement of apparatus for the administration of volatile anæsthetics by the closed method. The most modern of these appliances carry cylinders of carbon dioxide and oxygen in addition to ethylene, nitrous oxide, and an apparatus for giving ether as well. This has greatly increased the value of carbon dioxide,

which can now be used to give a smooth and rapid induction of anæsthesia in a struggling patient or in one who persists in holding his breath. When an adequate amount of carbon dioxide is administered to the patient along with the anæsthetic, he simply cannot help taking it in long, deep breaths. During the operation anæsthesia can be rapidly deepened or lightened by simply giving the patient a mixture of carbon dioxide and oxygen with or without the anæsthetic. This has been clearly described by Lundy in a resumé of the use of carbon dioxide at the Mayo Clinic. He also tells us that at the end of operations where the anæsthetic has been given by the closed method, a mixture of carbon dioxide and oxygen is administered while the dressing is being applied without in any way prolonging the patient's stay in the operating room. The resulting five minutes of increased breathing is sufficient to eliminate a greater part of the anæsthetic, if it is ether, and nearly all of it, if it is nitrous oxide or ethylene. This is of sufficient benefit to make the routine use of carbon dioxide in this manner seem well worth while.

Carbon dioxide: Its place in anæsthesia. RALPH MILTON WATERS. *Canadian Med. Assn. Jl.* Dec., 1927

Dr. Waters sounds a note of warning to those who resort to carbon dioxide promiscuously. He thinks that the time has arrived when it is necessary to point out that this gas has its limitations as well as uses. He believes that the mere fact that anæsthesia can be more quickly and conveniently induced and terminated by it is not sufficient ground for administering it. The one criterian should be : can the acid-base balance be more carefully guarded in a given case by the addition of carbon dioxide or by its complete or partial removal from the respiration medium ?

Dr. Waters studies the subject from a physiological standpoint and is conducting his experiments with that end in view. His six months consideration makes him conclude that changing the amount of carbon dioxide inspired by sick patients is interfering with fundamental physiology and should not be undertaken lightly, although he thinks that its use by the anæsthetist can be put on a rational basis. In the meantime he advises conservatism.

REGIONAL ANÆSTHESIA.

SOME CONCLUSIONS FROM OVER 800 MAJOR OPERATIONS UNDER LOCAL ANÆSTHESIA.

By Dr. Lanning E. Likes of Lamar, Colorado.

IN a paper written in 1918 I made the statement that post-operative pneumonia was due to inhalation anæsthesia. However, I am now fully convinced that pulmonary embolism and infarction are the real etiological factors in post-operative pulmonary complications. Neverthless, I think that general anæsthesia is a contributing factor worthy of serious consideration in some of our aged patients who have chronic exudative bronchitis. Fortunately, local anæsthesia has passed through the pitfalls of the early experimental stage and at the present time has many enthusiastic workers the world over.

Quoting Wm. J. Mayo in his foreword to Labat's recent book, "The young surgeon should perfect himself in the use of regional anæsthesia, which increases in value with the increase in the skill with which it is administered. The well-equipped surgeon must be prepared to use the proper anæsthesia, or the proper combination of anæsthesia, in the individual case. I do not look forward to the day when regional anæsthesia will wholly displace general anæsthesia; but undoubtedly it will reach and hold a very high position in surgical practice."

The above statement made five years ago is entirely true at the present time, and if you will pardon my enthusiasm for making a statement contrary to so eminent an authority, I do look forward to the day when local or regional anæsthesia, in some of its modifications, will be the anæsthesia of choice.

We operate on a number of tuberculous patients and I believe all forms of inhalation anæsthesia positively contra-indicated. It has been my experience that tuberculous

patients do not stand surgery well, and I believe that surgery under local anæsthesia or some form of regional anæsthesia should be reserved for those who have a very definite positive indication.

During my army service my observations were that the surgical mortality was appalling in empyema cases. Surgeons were changed and various methods introduced, but in spite of this the mortality remained extremely high. But under local anæsthesia the mortality was greatly reduced.

With local anæsthesia it is not necessary to starve the patients before hand and in debilitated subjects this is a great advantage. Post-anæsthetic disturbance of the alimentary canal is not present. Dilatation of the stomach and intestinal paresis are eliminated.

In tuberculosis and various wasting diseases where maintaining nutrition is of vital importance, local anæsthesia has a decided advantage as there is very little interruption to nutrition. The complete relaxation under general anæsthesia is responsible for the severe pain often complained of in the back. This is avoided with local anæsthesia on a properly padded table.

Before the discovery of insulin and the use of local anæsthesia, operations on diabetics was a dreaded procedure. Now with proper preliminary treatment and the use of local anæsthesia these cases can be made fairly good operative risks.

Post-operative vomiting is extremely rare following the use of local anæsthesia. Undoubtedly localized abdominal infection is spread by vomiting. I recently operated on a seven year old boy who came seventy-five miles over rough roads with a ruptured appendix and very extensive peritonitis. This child was in a desperate condition and looked hopeless. I told him what I intended to do and with his co-operation a ruptured appendix, with no walling off, was removed. I am confident that general anæsthesia would have caused his death. It has been said that children, generally speaking, are not good subjects for local anæsthesia. I do not agree with this statement, for in the past few months I have removed appendices from children seven, nine, eleven, and twelve years old respectively.

I think post-operative vomiting is a factor in recurrence in hernia operations. I recall distinctly a case on my service while an intern. During a severe attack of vomiting the abdominal wound broke open and several feet of bowel were pushed out. I had a similar experience in my own work several years ago.

Since it has been so definitely established by Crile that trauma plays an important part in shock, the successful application of local anæsthesia, gentle, careful manipulation and avoidance of traction, will almost eliminate this surgical complication.

I will discuss briefly the disadvantages of local anæsthesia which are more imaginary than real. It has been claimed that local anæsthesia interferes with wound healing. I am sure this is an error and that such occurrences are due to faulty technique. In a series of over three hundred cases I had trouble with primary healing in one case and I am confident it was due to faulty technique and not the anæsthesia. The patient was a debilitated subject and I was using intradermal anæsthesia and feel certain that too much pressure was used. I have since discontinued intradermal, and am now using subcutaneous infiltration, and have not had any trouble whatsoever with primary wound healing. In conversation with men who have had a vast amount of experience with local anæsthesia I find they are of the same opinion.

Since I believe many failures are due to faulty technique in preparation I give in detail the method described by the chemist who has prepared my solutions for ten years. It is essential that absolute asepsis be observed in preparing the solutions.

After cleansing all utensils to be used, take a sterile two ounce metal screw cap Jena glass bottle. Into this weigh exactly nine grains of novocaine. After the novocaine is put into the bottle, weigh exactly seven grains of sodium chloride, chemically pure and put into the bottle with the novocaine. To this mixture of chemicals add two ounces of pure distilled water and screw the cap on loosely.

This solution is then put into a sterilizer and the water of the sterilizer brought to boiling. After the water in the

sterilizer starts to boil keep it boiling for ten to fifteen minutes. This length of time has been found sufficient to sterilize the solution in the bottle.

The solution is now taken from the sterilizer and four drops of adrenalin (Parke, Davis and Company), added for each ounce of sterile solution. This solution is now put back in the sterilizer and boiled for three minutes. The solution will now turn a light brown colour, which does not seem to affect its action as a local anæsthetic. It has been found if the solution is boiled more than three minutes it turns a dark brown and does have some effect on the action of the solution as a local anæsthetic.

The solution after three minutes, is taken from the sterilizer, the cap screwed down tightly. Then dip the cap and neck of the bottle in alcohol to further protect against contamination from the fingers. After removing the bottle from the alcohol, a pad of cotton, dipped in alcohol, is placed over the cap and secured with a rubber band.

We have found that if the local solution is made freshly, say fifteen minutes before the operation, it is more effective in its action. Therefore we always prepare it not more than one-half hour before the operation.

The cotton is put on the metal cap of the bottle for two reasons, first to prevent contamination in delivering to the place of operation, and second that the nurse may remove the cap without touching the neck of the bottle with the fingers. Sometimes the cap sticks and an instrument is needed to remove same. If such is the case the cotton aids in the removal by giving a firmer hold on the cap.

Some operators are not able to satisfactorily explore the abdomen, but with increasing experience, more patience, and by taking advantage of the suggestions of Farr, namely, "By making use of the force of gravity through longitudinal or lateral tilting of the table, movable organs may be made to slip into the field or out of the way as desired. Aside from thorough anæsthetization of the abdominal wall, the avoidance of any act that will produce pain, and the use of tilting, vertical retraction of the abdominal wall is one of our strongest strategic measures: and when this is used in conjunction with the others it will reveal the abdominal cavity

to the extent of allowing an examination directly under the eye, with which a digital examination cannot compare in the matter of efficiency."

It has been said that local anæsthesia takes too much time. I would like to quote from an article written by Joseph R. Eastman: "A very distinguished surgeon has recently said that he has not the time to perform prostatectomy under local anæsthesia. This, I think, should be taken literally. This man, one of the most brilliant of American Surgeons, is perhaps too busy to use local anæsthesia for prostatectomy, although the additional time required is very slight. However, in this case, should not these old patients with defective hearts, lungs and kidneys be turned over to those of reasonable skill who have time enough to provide for the patients the important safeguard given by local anæsthesia? I have found that it cheers these old men to tell them that their operation can be done under local anæsthesia without pain, it strengthens their morale. Like children, they are peculiarly susceptible to suggestion."

"I believe that the teaching of this distinguished man in relation to this particular subject is bad. So brilliant is the virtuoso-ship of this operator, so inspiring is his personality that his visitors are thrilled by him in a state of mind in which they are prepared to believe anything he says, and in which they would give little heed to the utterances of a plodding advocate of local anæsthesia. Nevertheless, if the surgeon is willing to give something of himself to his patient; to make some sacrifices of his own stamina, he can with local anæsthesia safely operate upon a considerable portion of prostatic hypertrophies which, under inhalation anæsthesia, could not safely be operated upon."

Certainly I find some apprehensive patients that are not ideal subjects for local anæsthesia, but should occasion arise for the necessity of its use I would not hesitate to spend considerable time in an endeavour to convince them that the work could be done without pain and to their entire satisfaction. It is most gratifying afterwards to have these patients greet you with a smile and say, "Doctor, I am glad that I had local anæsthesia." To-day I had two patients make the above statement.

In the hands of a capable surgeon experienced with regional anæsthesia, many operations, no matter how formidable, can be done. However, failures, for one reason or another do occur. Usually faulty technique, and occasionally the patient loses confidence. However, I see no reason why, in a case of this type, that a short general anæsthesia would not be preferable to a prolonged one. In my early work in removing an adherent retrocecal appendix it was occasionally necessary to resort to a little inhalation anæsthesia. I have used a few whiffs of ethyl-chloride satisfactorily and for those who prefer gas-oxygen, it is ideal.

Surgeons who use local anæsthesia have long searched for an efficient non-toxic local anæsthetic. I have twice seen mild toxic symptoms from novocaine used in less than 2 per cent. strength with the addition of five drops of a 1-1000 adrenalin chloride solution to the ounce. These consisted of nausea, pallor, and in one case fainting, but lasted for a very short time. It has been a question in my mind if nervousness possibly was not a contributing factor. I have been using novocaine since 1912. It meets the requirements for an ideal anæsthetic, being non-toxic, causing no local disturbances, being readily sterilized by boiling, compatible with adrenalin and sufficiently lasting for the most protracted operations. I have used it in various strengths; before the war I was using one-half of 1 per cent. with five drops of adrenalin solution 1-1000 to the ounce. After the war was declared, owing to our limited supply, I began using one-fourth of 1 per cent. with equal success. A little more time is necessary to establish anæsthesia with the weaker solution. The introduction of adrenalin or its synthetic substitute has constituted a marked advance in local anæsthesia. The form in which it is commonly used is the solution of adrenalin chloride 1-1000, in physiological salt solution, with the addition of 0.5 per cent. of chloretone.

I have given the synthetic substitute a thorough trial but fail to find any advantage over the organic preparation. I use adrenalin in all cases except toxic goiter. The question of the quantity of adrenalin deserves consideration. It should be remembered that after the ischaemic effect of

the adrenalin has worn off we have a dilatation and are liable to hæmorrhage. A forceful illustration of this point was brought to my attention about six years ago. I removed an appendix under novocaine—adrenalin anæsthesia which was followed by troublesome oozing. I ligated the larger vessels and felt confident a little pressure would stop the remaining superficial oozing. But on the third day it was necessary to open the wound and ligate many minute vessels. Perfect hæmostasis should be secured when working with adrenalin. The quantity of adrenalin used should be carefully regulated. How much can be used with safety I do not know. I have never used more than eight drops of 1 in 100,000 strength. If I were to use more solution I would decrease the adrenalin to 1 in 150,000 to 1 in 200,000.

All of the cases here reported have been operated upon with novocaine-adrenalin with the exception of the rectal cases where I have used quinine and urea hydrochloride in combination with adrenalin-novocaine. The anæsthetic effects of quinine and urea last for several days and I have found this is very gratifying to the rectal patients.

In order to avoid toxic effect a freshly prepared isotonic solution of one-half per cent. procain (American novocaine) with adrenalin chloride should be used. A great many competent surgeons consider apothesine as good as novocaine. The drug differs in two essentials; novocaine is made with ethyl alcohol and benzonic acid, and apothesine with propyl alcohol and cinnamic acid. The Council on Pharmacy and Chemistry rated apothesine twice as toxic as procain.

I have never used cocaine, but in view of a conversation several years ago with Dr. Lyons of Rochester, I am inclined to believe that its toxicity has been over-estimated. He informed me that he had seen no toxic effects in a series of several thousand cases when cocaine one-tenth (1-10) per cent. with adrenalin had been used.

In a letter from Dr. J. L. De Courcy, of Cincinnati, he states, "We have used nothing but cocaine during the past five years and have yet to see a case of poisoning or even idiosyncrasy." He uses 0.2 per cent. in the skin and to block the nerves, and 0.1 per cent. for infiltration.

Dr. Eastman says, "It is, I presume, clear that the use of cocaine alone or as an adjuvant to novocaine, may militate not infrequently against the preservation of a serene state of mind. I have observed this in suprapubic prostatectomies after dropping cocaine into the bladder to anæsthetize the mucosa, the stimulation of cerebration, the sharpened special senses, the loquacity and anxiety very promptly coming into evidence as embarassing agencies. The lesson here is not far to seek. It is to avoid the use of cocaine whenever possible." Opinions of capable men seem to be divided. Novocaine has proven so satisfactory that I see no reason for changing.

Preparation of the patient is the same as for general anæsthesia. It is necessary to gain absolute confidence. He must have assurance that the operation can be done painlessly. The frequent suggestion that he will suffer no pain and complimenting him upon the courage he is displaying are often helpful to the patient. We plug the patients ears with cotton, as the sound of instruments sometimes annoys them. A moistened cloth is placed over the eyes. The nurse engages the patient in conversation when inclined to be nervous.

Preliminary injections of morphine are a great aid in work under local anæsthesia. The patient's senses should be sufficiently numb so he does not worry. In our first cases we were using preliminary injections of hyoscin with morphine, but owing to occasional noisy delirium produced by hyoscin, we have discontinued its use and are now using morphine, one-fourth grain, in combination with atropine one-hundred-fiftieth grain, one-half hour before operation. A few cases have required a second injection of a sixth or an eighth grain of morphine.

Allen recommends preliminary injection of pantopon, one-sixth to one-half grain in combination with scopolamin, one-hundred-fiftieth grain. I have used this combination in a number of cases, but prefer morphine and atropine. I have also tried morphine in combination with magnesium sulphate as recommended by Gwathmey.

The details of technique are most important.. I have found the 5 c.c. Luer, Record and Vim syringes all satisfactory. Lately I have been using a special 5 c.c. Luer Lok

syringe made for me with some of my suggestions by Becton Dickinson & Co. I use rustless steel needles varying in length from one-half to four inches, twenty-three guage. Again let me emphasize the fact that nothing but a freshly prepared isotonic solution should be used. The injecting is always done with rubber gloves, and the needle never allowed to touch the skin. In starting the injection, the patient is informed that he will feel the first needle prick. It is essential not to destroy the patient's confidence. A small fold of skin is pinched up and the short needle inserted very superficially, and almost parallel to the skin. This produces intradermal anæsthesia. Subsequent injections are made subcutaneously by means of the long needle introduced through the intradermal wheal. The solution is deposited in the subcutaneous tissue as the needle is being advanced in the direction of the proposed incision. A very wide area can be infiltrated with the long needle through the single intradermal wheal. It is very easy and one becomes quite skillful after a little experience in injecting the deeper layers. The sense of resistance offered to the needle readily informs you what structures are being injected. Since the parietal peritoneum is quite sensitive, unless you are sure it has been anæsthetized it may be best to infiltrate it after exposure. I have demonstrated, approximately one hundred times, satisfactory removal of the appendix with no injecting after the operation was started.

The meso-appendix is generally considered quite sensitive but in a patient who has had a preliminary narcotic, by the avoidance of traction it is possible to apply, very gently, a hæmostat and crush the meso-appendix without distressing the patient. After the meso-appendix is cut the appendix can be removed without any pain whatsoever. It is not necessary to inject the base of the appendix. However, in doing abdominal surgery one must bear in mind that the meso-appendix, round and broad ligaments, mesentery, and the tissue around the bile ducts are sensitive and should be infiltrated.

The majority of these cases have been operated upon with infiltration technique, some under field block. The hernias under infiltration combined with direct nerve block; ampu-

tations under direct nerve block; all bladder work trans-sacral combined with infiltration.

I recently read an article in which Dr. C. N. Cowden says that for local anæsthesia to be successful you must have an organized hospital with special trained orderlies, interns, and house surgeon. I agree with Dr. Cowden that this would be a wonderful help but I have never been fortunate enough to have a well organized hospital with all accessories to work in. It is in just such communities that I live in where well trained anæsthetists are not always available, that local anæsthesia will be a step forward in helping to save many lives.

These were all private cases and do not include my army work with local anæsthesia.

In closing I would like to quote from Rudolph Matas, one of the masters of local anæsthesia; "Whatever may be the limitations of regional anæsthesia and the objections that have been argued against it, no one can deny that it has given a new impetus to anatomic teaching; that it has placed a high valuation upon an exact anatomic training and that in this way it is making it less possible for the mere cutter, the "cut and tie"type of practitioner, to be confused with the real surgeon. For this reason alone it deserves the encouragement and fostering care of every surgeon and every teacher who has at heart the higher welfare of his science and art."

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EXTRACTS FROM AN ADDRESS ON THE SURGEON AND THE ANÆSTHETIST.*

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AT a recent discussion on anæsthesia before the American Surgical Association (May, 1927), Dr. Finnay stated his opinion that possibly the greatest real advance in our surgical life time, was the introduction of the trained anæsthetist. The President, Dr. Harvey Cushing, accentuated this view when he remarked that he considered the choice of an anæsthetist was often more important than the choice of the anæsthetic, a sentiment which has frequently been voiced by the writer, in similar terms. Dr. Cushing also told us that when he had himself to take a general anæsthetic, he chose chloroform, because he knew that the man who was on that occasion selected to give the anæsthetic was most expert in the administration of chloroform. Thus it comes about that to-day the specialist in anæsthesia fills a rôle of the greatest significance in the conduct of surgical procedures. A rôle the importance and responsibility of which cannot be exaggerated.

When we speak of the "trained anæsthetist" we refer to one who specializes in anæsthesia, and it is to the advent of such an one we refer, when recording the pre-eminent contribution made by him to the progress of surgical art.

The relationship subsisting between the surgeon and the anæsthetist must vary, first, with the skill of the anæsthetist, and secondly, with the skill of the surgeon in every varying combination. There must be co-operation between the two, but the experienced anæsthetist on the one hand, and experienced surgeon on the other, must recognize that for either of them to work with an unskilled colleague produces a situation full of difficulty and danger.

* Read at the Annual Meeting of the Canadian Medical Association Toronto, June 16, 1927.

The writer recalls being present at an operation on one occasion when the anæsthetic was being administered by one whose qualifications and skill were unquestioned. The surgeon, in the course of an abdominal operation, made a vigorous pull on the mesentery, the patient promptly stopped breathing, the surgeon, who was a stranger to the anæsthetist, turned to abuse the anæsthetist, failing to realize that his own rough manipulation was responsible for a reflex effect on respiration, which, fortunately, was only of a temporary nature. Here was a lack of co-operation and understanding which was unpardonable. The surgeon in this particular instance was a man of wide experience, but one who had not learned the value of gentle manipulation. There are, however, incompetent persons who assay to do surgery; they are usually shrewd enough to secure a skilled anæsthetist much to the discomfort of the latter, who has an undue and unwarranted amount of responsibility thrust upon him. It thus comes about that complete and effective co-operation may fail because of lack of skill in either the surgeon or the anæsthetist. Varying degrees and combinations may exist on occasion and the departure from the ideal may be extreme.

The trained anæsthetist and the skilled operating surgeon may effect a co-partnership which affords an opportunity for effective team work, the importance of which in attaining ideal results can hardly be exaggerated. It is this combination which may be referred to as possibly "the greatest real advance in our surgical life time." Assuming we are dealing with individuals thoroughly trained and skilled in their respective spheres we may establish conditions approaching the ideal. It is during the administration of the anæsthetic that the most important field for co-operation exists. It is of undoubted advantage that an individual surgeon should always work with the same anæsthetist or same group of anæsthetists. A sympathetic co-operation naturally results from such combinations—a co-operation which is difficult or impossible to maintain if the surgeon and anæsthetist are strangers to one another.